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Quality of Canadian soybeans

2007

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Summary

For 2007, the Canadian average oil content of 21.7% was similar to the 21.6% in 2006 and 0.7% above the five-year (2002-2006) mean of 21.0%. The 2007 average protein content of 40.3% was higher than the 40.0% in 2006 but 0.7% below the five-year-mean value of 41.0%. However there are notable regional differences in the quality parameters of the 2007 soybean crop. For the 2007 harvest survey, oil contents from Ontario and Manitoba soybeans were higher than those from Québec while protein contents from Ontario and Québec were notably higher than those in Manitoba.

Compared to 2006, the 2007 Ontario average oil content of 21.9% is 0.5% higher and the average protein content of 41.1% is 0.6% higher. Compared to 2006, the 2007 Québec average oil content of 20.2% is 0.2% higher while the average protein content of 40.9% is 0.7% lower. Compared to 2006, the 2007 Manitoba average oil content of 21.8% is 1.7% lower while the average protein content of 37.2% is 0.6% higher.

Introduction

This 2007 report provides quality data on the 216 non-food grade soybean samples submitted to the Grain Research Laboratory (GRL). This is significantly fewer than the 494 samples tested in 2006. The Canadian Grain Commission collected the Ontario and Québec harvest survey samples with the assistance of the Ontario Soybean Growers (OSG), the Canadian Soybean Exporters Association (CSEA) and the Québec Agricultural and Food Market Control Board. The western Canadian soybean samples were collected from soybean growers and handlers with the assistance of Manitoba Agriculture and Food. The data in this survey included 158 samples from Ontario, 37 from Manitoba, 19 from Québec, and two from Saskatchewan. The data has been treated collectively but the information from the provinces was also compared. According to CGC grain inspectors, 85 of the samples graded Soybean, No.1 Canada, 123 graded Soybean, No.2 Canada, five graded Soybean, No.3 Canada, one graded Soybean, No.4 Canada, and three graded Soybean, Sample Canada.

Some samples were identified as “white hilum” or food bean types that typically contain higher amounts of seed protein. It was assumed in this report that these white hilum samples did not meet food grade specifications and would be used for crushing or feeding purposes.

Weather and production review

Weather review

Details of the entire Ontario and Manitoba growing seasons can be found at <http://www.omafra.gov.on.ca/english/crops/field/reports/2007summary-d.htm> and <http://web2.gov.mb.ca/agriculture/mwcr/index.php> respectively. Information on the other soybean growing areas can be found at <http://infohort.agr.gc.ca/index.cfm?action=dspNCNCropNewsRpt&lang=eng>.

Excellent early spring weather and good soil conditions resulted in an early start to the Ontario soybean seeding. The majority of the crop was planted between May 5 and May 25. The Ontario 2007 growing season was close to normal in terms of Crop Heat Units (CHU) but precipitation was generally below average in most regions. Due to the dry growing conditions during July and August many pods were aborted and resulted in below average yields. Low seed moistures at harvest resulted in some additional seed losses, cracked seed coats and green stems. The 2007 Ontario soybean harvest was over 75% completed by mid October.

The Manitoba soybean crop is usually grown in the south-central part of the province where there typically is a higher total accumulation of CHU. The majority of the Manitoba soybean crop was planted in the Red River Valley but the growing region stretched west to the area around Carman and Treherne (Figure 2). Temperature and precipitation patterns for the 2007 western Canadian growing season can be found on the PFRA web site (http://www.agr.gc.ca/pfra/drought/drmaps_e.htm).

The prairie provinces experienced wet spring weather to start the 2007 growing year resulting in good planting conditions for Manitoba. Precipitation during June was close to normal or above normal in most of the regions. Above normal temperatures moved into the western areas of the Prairies during early July and migrated to eastern regions by the middle of the month. The drier and warmer than normal growing period allowed for quicker crop maturity and an earlier than normal harvest. Cooler weather returned to the Prairies by the middle of August. For the early-planted soybean, the Manitoba harvest began in the first half of September and the harvest was estimated to be 75% completed by the beginning of October.

Production and grade information

Canadian soybean production in 2007 decreased by 22% to 2.70 million tonnes from last year's production of 3.47 million tonnes (Table 1). In Ontario, soybean yields decreased to 2.2 tonnes /ha from the record 3.1 tonnes/ha in 2006. The total Ontario crop was estimated at 2.20 million tonnes in the 2007 crop year, a decrease of 25%. Other areas of significant soybean production for 2007 included Québec and Manitoba with 472,000 and 212,300 tonnes respectively. Yields for the 2007 Québec crop (2.7 tonnes/ha) were notably higher than in Ontario (2.2 tonnes/ha) and Manitoba (2.3 tonnes/ha). While the average yield

for Québec soybean remained similar to the 2006 value, the Manitoba average yield increased by 28% while the Ontario average yield decreased by 29%.

Based on the 2007 CGC survey, 96% of the Canadian soybean samples received were in the top two grades. Immaturity or green beans were not a major issue in the 2007 Manitoba soybean crop, with all samples falling in the top two grades. For Ontario and Québec, over 95% of the samples received were in the top two grades. Seed size was reported to be smaller than normal for Ontario samples.

Table 1 - Production of Canadian soybeans

Year	Seeded area	Production	Yield
	hectares	tonnes	tonnes/ha
1997	1 058 900	2 737 700	2.6
1998	977 800	2 730 500	2.8
1999	1 002 000	2 775 000	2.8
2000	1 066 500	2 698 300	2.5
2001	1 058 000	1 594 100	1.5
2002	974 700	2 220 100	2.3
2003	1 050 800	2 268 300	2.2
2004	1 225 900	3 041 500	2.6
2005	1 176 400	3 161 300	2.7
2006	1 213 500	3 465 500	2.9
2007	1 180 100	2 695 700	2.3

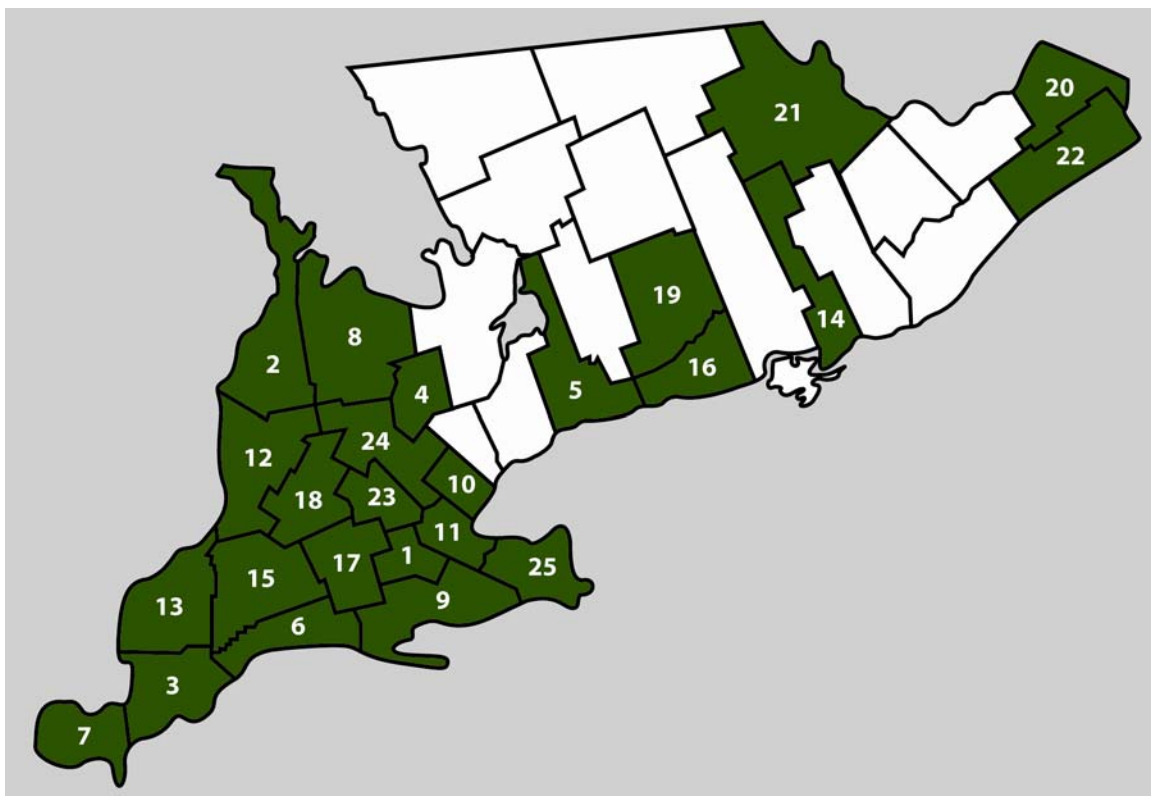
Source: Statistics Canada, *Field Crop Reporting Series, No.8, 1997-2007*

Harvest survey samples

This report provides quality data on the 216 non-food grade soybean samples submitted to the Grain Research Laboratory (GRL). The Canadian Grain Commission's Industry Services in Winnipeg, Manitoba graded the harvest survey samples. For the sixth consecutive year there were significant numbers of samples from Manitoba and Québec. While the data has been treated "collectively" the information from the provinces was also compared.

All samples were analyzed for oil and protein content using a Tecator Infratec 1241 Grain Analyzer near-infrared (NIR) spectrometer calibrated and verified against the appropriate laboratory reference method. Grade composite samples were analyzed for fatty acid composition and free fatty acids. The reference procedures are listed on the CGC web site under Oilseeds Methods <http://www.grainscanada.gc.ca/Quality/Methods/oilseedmethods-e.htm>.

Figure 1 – Map of southern Ontario showing counties of origin for 2007 soybean survey samples



1. Brant	8. Grey	14. Lennox & Addington	20. Prescott & Russell
2. Bruce	9. Haldimand & Norfolk	15. Middlesex	21. Renfrew
3. Chatham-Kent	10. Halton	16. Northumberland	22. Stormont, Dundas & Glengarry
4. Dufferin	11. Hamilton-Wentworth	17. Oxford	23. Waterloo
5. Durham	12. Huron	18. Perth	24. Wellington
6. Elgin	13. Lambton	19. Peterborough	25. West Lincoln-Niagara
7. Essex			

Figure 2 – Map of southern Manitoba showing rural municipalities of origin for 2007 soybean survey samples

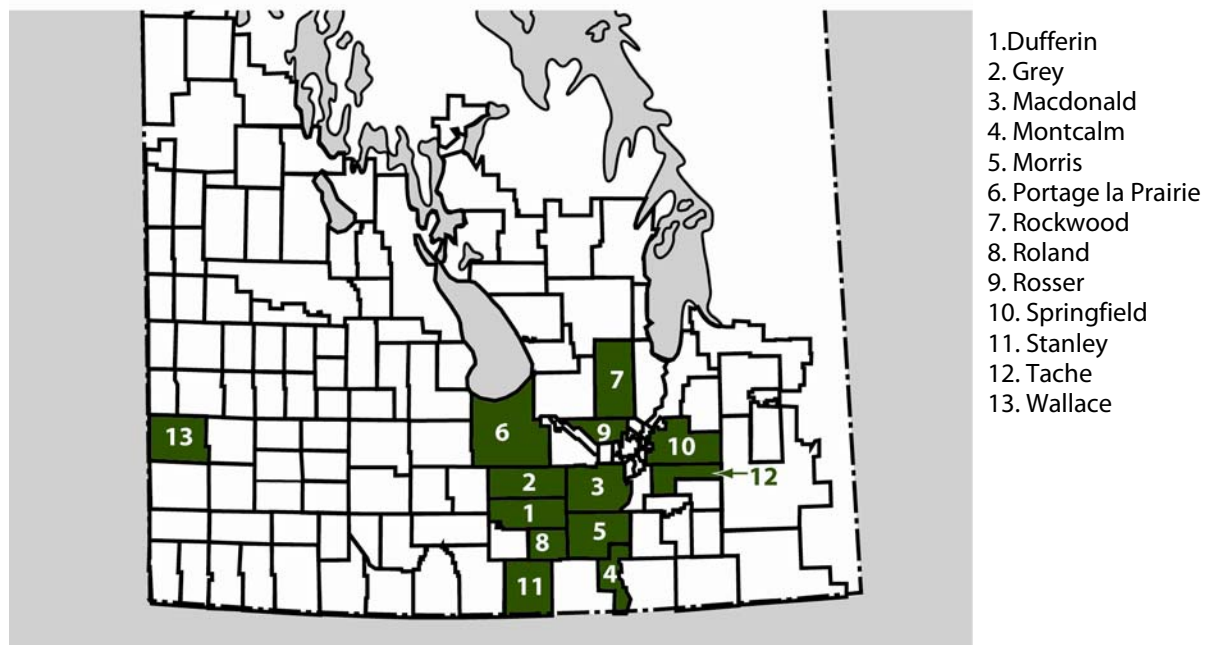
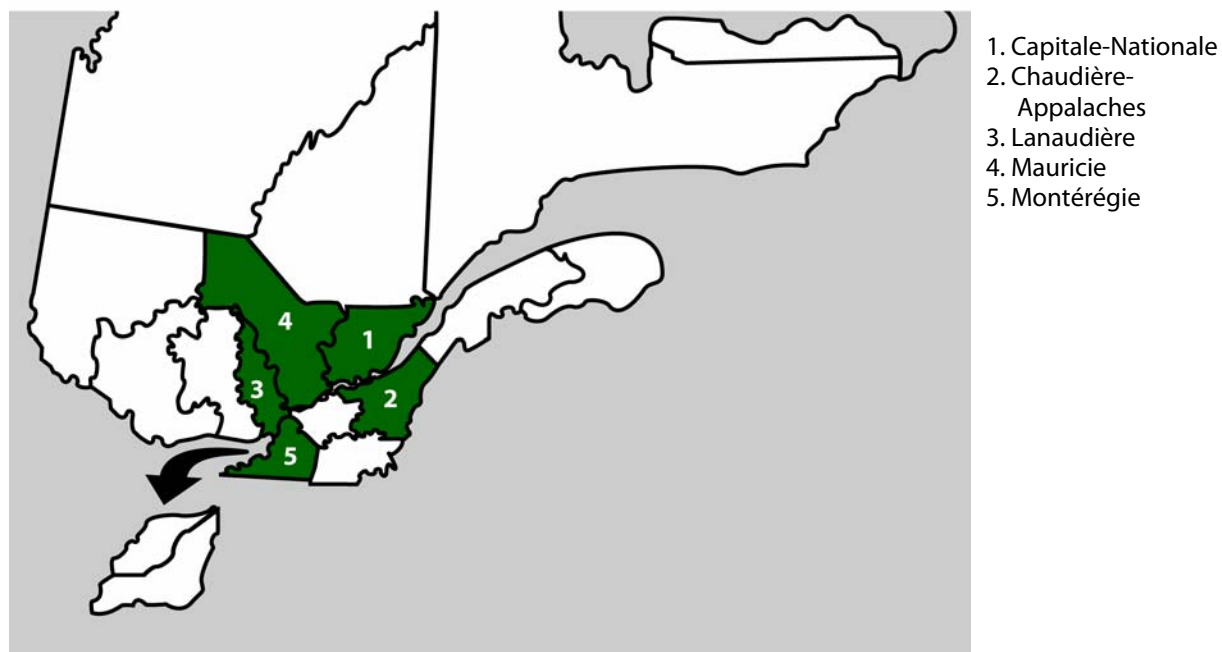


Figure 3 – Map of Québec showing regions of origin for 2007 soybean survey samples



Quality of Canadian soybeans – 2007

There are two major types of soybeans grown in Canada, commonly referred to as oil (or “crush”) beans and food grade beans. This report deals with the “non-food grade” samples and thus could be considered those destined for the feed or crushing industry. A listing of Canadian soybean varieties is provided in *List of Varieties which are Registered in Canada*, Variety Registration Office, Variety Section, Plant Health and Production Division, Canadian Food Inspection Agency (http://www.cfia.acia.agr.ca/english/plant/variety/list_e.html).

Oil beans are grown for producing oil and high-protein meal. Soybean oil is used in salad oil, shortening and margarine products. Defatted soybean meal is used as a protein supplement in livestock rations. Key quality factors for oil beans are oil content, protein content, and the fatty acid composition. Oil and protein content give quantitative estimates of the beans as a source of oil, and of the defatted meal as a source of protein for animal feed. The fatty acid composition provides information about the nutritional, physical and chemical characteristics of the oil extracted from the beans.

Food beans are varieties of soybeans that have been bred for specific qualities required in the production of traditional soyfoods. The quality of these beans is measured by such attributes as a clear or white hilum, larger seed size, and higher protein content. White-hilum soybeans that do not meet quality standards for food processing are used as oil beans or feed beans. Some of these samples would have been part of the 2007 crush bean survey. Quality of the designated Canadian food grade samples is not discussed in this report.

Oil and protein content

The oil and protein data in this report was collected using a Tecator Infratec 1241 Grain Analyzer near-infrared (NIR) spectrometer calibrated and verified with the reference procedures listed under the Oilseeds Methods section. The data in the following oil and protein discussions is based on the Soybean, No. 1 and No. 2 Canada “combined grade means” for the entire non-food grade samples received from Ontario, Québec, Saskatchewan and Manitoba (Table 2). In addition, a comparison by grades and provinces is also provided in Table 3.

For 2007, the Canadian average oil content of 21.7% was similar to the 21.6% in 2006 and 0.7% above the five-year (2002-2006) mean of 21.0%. Individual producer samples varied in oil content from 17.3% to 24.0%. The 2007 average protein content of 40.3% was higher than the 40.0% in 2006 but 0.7% below the five-year-mean value of 41.0% (Table 2). Individual producer samples varied in protein content from 32.3% to 47.6%.

Compared to 2006, the Ontario 2007 samples contained 0.6% more protein and 0.5% more oil. Because of the increasing amounts of white-hilum beans being produced in Ontario, long-term oil and protein trends may not be as clear as in earlier years when surveys contained mainly dark hilum, “crush” beans. Some

white-hilum soybeans that do not meet quality standards for food processing are also used as “crush” beans and may be submitted to this survey.

Compared to 2006, the Québec 2007 samples contained 0.7% less protein and 0.2% more oil. Because of the increasing amounts of white-hilum beans being produced in Ontario, long-term oil and protein trends may not be as clear as in earlier years when surveys contained mainly dark hilum, “crush” beans. Some white-hilum soybeans that do not meet quality standards for food processing are also used as “crush” beans and may be submitted to this survey

Compared to 2006, the Manitoba 2007 samples contained 0.6% more protein and 1.7% less oil. For the 2007 survey (Table 3), samples from Manitoba, which had above average heat units, were still significantly lower in protein but not significantly different in oil content than samples from Ontario. The differences in the mean oil and protein contents for the Ontario and Manitoba samples are most evident in the top two grades of soybean. The Soybean, No. 2 Canada grade includes sufficient numbers of samples for meaningful comparisons (Table 3). While quality parameters can be strongly affected by environmental conditions such as heat and drought stress, the variety of soybean planted plus soil fertility can also affect quality parameters. The strong inverse relationship between oil and protein content is illustrated in Figure 4 for both growing regions.

Fatty acid composition

The fatty acid composition of the Ontario soybean grade composites from the 2007 harvest survey showed only small differences between the top two grades (Table 5). However, compared to 2006, the grade composites had some changes in the fatty acid profiles. For the Ontario Soybean, No. 1 and No. 2 Canada grade composites there were decreases in linolenic acid of 1.6% and 1.9% respectively. The sum of the two major saturated fatty acids, palmitic and stearic acid, were about 0.6% higher than in the 2006 composites. Compared to 2006, the 2007 Ontario oil from the Soybean, No. 1 and No. 2 Canada grade composites had iodine values that were 5 and 6 units lower.

The fatty acid composition of the Québec soybean grade composites from the 2007 harvest survey showed only small differences between the top two grades (Table 5). However, compared to 2006, the grade composites had some changes in the fatty acid profiles. For the Québec Soybean, No. 1 and No. 2 Canada grade composites there were decreases in linolenic acid of 2.7% and 1.7% respectively. The sum of the two major saturated fatty acids, palmitic and stearic acid, were about 0.4% higher than in the 2006 composites. Compared to 2006, the 2007 Québec oil from the Soybean, No. 1 and No. 2 Canada grade composites had iodine values that were 4 units lower.

The fatty acid composition of the Manitoba soybean grade composites from the 2007 harvest survey showed only small differences between the top two grades. Compared to 2006, the Manitoba Soybean, No.1 and No.2 Canada composites had significant increases in linolenic acid of 1.9% and 2.3%

respectively. Compared to 2006 the sum of the two major saturated fatty acids, were only 0.1% and 0.5% lower for the Soybean, No. 1 and No. 2 Canada grade composites. Compared to 2006, the 2007 Manitoba oil from the Soybean, No. 1 and No. 2 Canada grade composites had iodine values that were 4 and 6 units higher. Because of the relatively few samples tested from Québec the fatty acid profiles should be used with caution.

The growing conditions likely contributed to notable differences in the fatty acid composition between the Manitoba and Ontario top grade composites (Table 5). The Manitoba Soybean, No. 1 and No. 2 Canada grade composites had significantly more linolenic and linoleic acid but less oleic acid than the Ontario composites in 2007. In addition, the Manitoba composites had an overall iodine value that was 4 and 7 units higher than the Ontario Soybean, No. 1 and No. 2 Canada grade composites.

Free fatty acid (FFA) content

The top grade composites analyzed in 2007 had very low levels of FFA, less than 0.1%. However some of the 2007 lower grade composites and samples contained somewhat higher levels of FFA. Unlike some years, when the majority of lower grade samples were down graded due to damage from insects boring into the seeds, the 2007 down-graded seeds were not from insect damage. Any damage which exposes the inside of the seed to moisture and oxygen may result in oxidation of the oil and a notable rise in FFA content.

**Table 2 – Quality data for harvest survey soybeans – all types
Soybean, No. 1 and No. 2 Canada grades combined data¹**

Quality parameter	2007	2006	2005	2004*	2002-2006
Oil content ² ,%	21.7	21.6	21.5	19.7	21.0
Protein content ³ ,%	40.3	40.0	40.2	42.3	41.0

¹ Means for the combined grades

² Dry matter basis

³ N x 6.25, dry matter basis

* 2004 data did not contain any Ontario survey samples

Table 3 – Oil and protein content of 2007 soybean survey by province and grade

Province	Number of samples	Oil content ¹ %			Protein content ² %		
		mean	min.	max.	mean	min.	max.
Soybean, No. 1 Canada							
Manitoba	14	21.5	20.0	22.8	37.7	34.8	40.7
Ontario	65	22.1	19.3	24.0	40.8	36.5	45.0
Québec	6	20.3	18.5	22.1	41.4	40.0	42.4
All provinces	85	21.8	18.5	24.0	40.3	34.8	45.0
Soybean, No. 2 Canada							
Manitoba	23	21.9	20.1	23.7	36.9	33.6	40.3
Saskatchewan	2	22.7	22.0	23.4	36.0	32.3	39.7
Ontario	85	21.7	19.6	23.3	41.3	37.0	45.9
Québec	13	20.1	17.3	21.4	40.7	33.5	47.6
All provinces	123	21.6	17.3	23.7	40.3	32.3	47.6
Soybean, No. 3 Canada							
Ontario	4	22.1	21.7	22.7	40.7	39.4	42.3
All provinces	4	22.1	21.7	22.7	40.7	39.4	42.3
Soybean, No. 4 Canada							
Ontario	1	22.6	22.6	22.6	42.0	42.0	42.0
All provinces	1	22.6	22.6	22.6	42.0	42.0	42.0
Soybean, Sample Canada							
Ontario	3	19.2	18.5	20.1	37.9	37.1	38.8
All provinces	3	19.2	18.5	20.1	37.9	37.1	38.8
Soybean, all grades							
Manitoba	37	21.8	20.0	23.7	37.2	33.6	40.7
Saskatchewan	2	22.7	22.0	23.4	36.0	32.3	39.7
Ontario	158	21.8	18.5	24.0	41.0	36.5	45.9
Québec	19	20.2	17.3	22.1	40.9	33.5	47.6
All provinces	216	21.7	17.3	24.0	40.3	32.3	47.6

¹ Dry matter basis

² N x 6.25; dry matter basis

**Table 4 – Comparison of 2004 to 2007 soybean data with five year means
Soybean, No. 1 and No. 2 Canada grades combined**

Year and region	Oil content ¹ %	Protein content ² %	Sum of oil and protein ² %
2007			
All regions	21.7	40.3	62.0
Manitoba	21.8	37.2	59.0
Ontario	21.9	41.1	62.9
Québec	20.2	40.9	61.1
Saskatchewan	22.7	36.0	58.7
2006			
All regions	21.6	40.0	61.6
Alberta	22.0	38.4	60.4
Manitoba	23.5	36.8	60.3
Ontario	21.4	40.5	61.9
Québec	20.0	41.6	61.6
Saskatchewan	22.6	38.7	61.3
2005			
All regions	21.5	40.2	61.7
Alberta	n/a	n/a	n/a
Manitoba	20.2	39.9	60.1
Ontario	22.6	40.6	63.2
Québec	22.5	39.3	61.8
Saskatchewan	n/a	n/a	n/a
2004			
All regions	19.7	42.3	62.0
Alberta	17.0	42.4	59.4
Manitoba	n/a	n/a	n/a
Ontario	n/s	n/s	n/s
Québec	19.8	42.3	62.1
Saskatchewan	n/s	n/s	n/s
2002-2006 means			
2002-2006 Ontario	21.4	41.4	62.8
2002-2006 Manitoba	21.2	39.5	60.7
2002-2006 Québec	20.8	41.5	62.3

¹ Dry matter basis

² N x 6.25; dry matter basis

n/s No survey samples received

n/a No Soybean, No. 1 or No. 2 Canada samples in survey

Table 5 – Fatty acid composition and FFA content for 2007 harvest survey soybean grade composites

Province	Fatty acid composition ¹					Iodine value ³	Free fatty acids %
	C16:0	C18:0	C18:1	C18:2	C18:3		
Soybean, No. 1 Canada							
Manitoba	9.8	4.3	20.9	53.3	10.1	137	0.02
Ontario	9.8	4.4	23.3	53.1	7.9	133	0.04
Québec	10.1	3.8	20.8	54.7	9.2	137	0.03
Soybean, No. 2 Canada							
Manitoba	9.5	4.3	19.7	54.6	10.4	139	0.02
Saskatchewan	9.8	4.9	25.0	49.1	9.4	131	0.02
Ontario	9.9	4.5	23.8	52.5	7.8	132	0.06
Québec	9.9	3.9	20.3	55.1	9.3	137	0.04
Soybean, No. 3 Canada							
Ontario	10.3	4.2	22.7	53.4	7.9	133	0.10
Soybean, No. 4 Canada							
Ontario	9.7	4.5	23.3	54.2	6.9	132	0.23
Soybean, Sample Canada							
Ontario	9.8	4.5	22.0	53.7	8.5	134	0.22

¹ Percentage of total fatty acids including palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3); other minor fatty acids totaled 1.4% to 2.0%

² As designated on the sample envelope

³ Calculated from the fatty acid composition

Figure 4 – Relationship between oil and protein content for 2007

